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ANOTHER LOCALITY OF EOCENE GLACIATION IN SOUTHERN COLORADO¹

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Since the publication of the paper on the Eocene glaciation recorded at the northwest base of the San Juan Mountains near the village of Ridgway,² the author's attention has been called to a similar discovery made by Mr. Charles W. Drysdale in British Columbia at about the same time.³

When Eocene till was found near Ridgway, and the formation was given the name Ridgway till, it was anticipated that other glacial deposits of the same age would soon be recognized in other parts of the Rocky Mountain province. Each of the larger ranges in this great geographic province has had a history somewhat similar to that of the San Juan Mountains. These ranges were all uplifted, some as great anticlinal arches, some as domes, and others with some faulting and intrusion, at the close of the Mesozoic era or beginning of the Cenozoic time. Those great arches and domes were dissected into mountain forms, and, when favorable climatic conditions prevailed, glaciers probably formed in many of the higher basins among those mountains and assisted in the further dissection of the ranges. Now that Eocene till has been discovered in British Columbia, and at a locality to be herein described near the south margin of the San Juan Mountains, it appears to be well established that conditions favorable for the formation of Alpine glaciers did obtain in the western portion of North America during early Tertiary time.

¹ Published with the permission of the Director of the United States Geological Survey.

² W. W. Atwood, "Eocene Glacial Deposits in Southwestern Colorado," *U.S. Geol. Survey, Prof. Paper 95-B*, 1915.

³ C. W. Drysdale, "Geology of Franklin Mining Camp, British Columbia," *Canadian Geol. Survey Mem. 56*, 1915.

The locality at which this most recent discovery of Eocene till in Colorado was made is about 20 miles southeast from Pagosa Springs and in the south-central portion of the Summitville quadrangle of the United States topographic atlas.

The deposit is exposed in the valley walls of White Creek where that stream is dissecting the surface of V Mountain. The best exposures may be reached by trail from the Blanco Basin, following the base of the bold mountain escarpment just east of V Mountain to a large lake held in by recent landslides, and thence westward half a mile to the junction of the two upper forks of White Creek.

The ridge between the two upper forks of White Creek and that west of the west fork are composed of this ancient till, but on their surfaces there are fragments of the later Tertiary volcanics that have fallen or been washed from the mountains to the east.

The till is composed of stones ranging up to 5 feet in diameter imbedded in a clay matrix. Many of the stones are distinctly striated, and most of them are subangular and beautifully polished and planated. The notable character of this till, however, is the abundance of stones that have come from the pre-Cambrian formations, now nowhere exposed near this locality, and the many boulders known to have come from the Cutler or Dolores formations of Permo-Triassic age which must also be buried in the core of the range. Of equal significance is the absence of stones from the later Tertiary volcanics. These two points make it clear that the ice which deposited this till formed and accomplished its work during the time when the pre-Cambrian core of the range and the upturned Paleozoic and Mesozoic formations were exposed at the surface, and before the later Tertiary lavas and tuffs were present.

The stones in this till consist of granites, quartz, quartzites, schists, gneisses, jaspers, red sandstones from the Cutler or Dolores formations, and conglomerates from one or the other of those formations. There are also many porphyries and some boulders of a tuff-breccia, just as there are in the type section of the Ridgway till. These igneous and volcanic rocks were derived from an earlier series of intrusives and eruptives and are quite distinct in age from the later volcanics which constitute the mass of the present mountains.

The lithological character of this drift is distinctly different from that of the three Pleistocene drift deposits which are so commonly found in the foothill regions bordering the San Juan Mountains, and which are all present in this immediate district. The Pleistocene glacial deposits are characterized by the stones of the later Tertiary volcanics and usually contain very little that could not have been derived from those volcanics.

In one exposure near the junction of the two forks of White Creek on V Mountain a pebble-clay till is exposed which resembles the upper member of the Ridgway till at the type locality. This pebble clay contains many stones less than one-quarter of an inch in diameter and a few cobblestones and small boulders. The best striae were found on stones that were taken from this pebble-clay phase of the till.

Beneath this exposure of Eocene till is the Mancos shale, and in this respect the conditions are identical with those at the northwest base of the range. Upstream from the best exposures of the till an andesitic rock cuts the Mancos shale and appears to be at the base of the till for some little distance. On the slopes above this deposit of till there are beautifully waterworn pebbles of pre-Cambrian rocks similar to those that characterize the Eocene glacial deposit. They appear to have come from the complete disintegration of a conglomerate. Such a conglomerate overlies the Ridgway till at almost all of the known localities.

This section is somewhat less satisfactory than many of those described in the first report on Eocene glaciation in the San Juan Mountains, for it is not at present overlain by the later Tertiary volcanics. The lithologic character of this deposit determines its age.